CLASSIFICATION OF THE ANIMAL KINGDOM.

A LECTURE

INTRODUCTORY TO THE COURSE OF

ANATOMY,

IN THE PHILADELPHIA SCHOOL OF ANATOMY.

DELIVERED BY

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At a general meeting of the Class of the Philadelphia School of Anatomy, held October 18th, 1860, for the purpose of publishing Dr. Agnew's Introductory Lecture, J. T. Chandler was called to the Chair, and C. B. Blackburn appointed Secretary.

The following Committee was appointed to carry out the desire of the Class:—

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CORRESPONDENCE.

Philadelphia School of Anatomy,
October 18th, 1860.

Dr. D. Hayes Agnew.

Dear Sir:—We, the undersigned, have been appointed a Special Committee by your Anatomical Class to request a copy of your Introductory Lecture, delivered on the 10th inst., for publication. Hoping that you will accede to this request of the Class, we are Respectfully, yours,

J. T. Reid, H. L. Rugely, H. Robinson, L. A. Wailes, B. J. Mosely, *Com.*

Philadelphia School of Anatomy,
October 21st, 1860.

Gentlemen:—I am in the receipt of your letter, communicating the flattering resolution of my Anatomical Class. The Address was not written with a view to publication, yet, under the circumstances, not feeling at liberty to refuse compliance with your kind request, I place the manuscript at your disposal.

I am, very truly, your obedient servant,

D. Hayes Agnew.

To Messrs. T. J. Reid, H. L. Rugeley, H. Robinson, L. A. Wailes, B. J. Moseley, *Committee.*

LECTURE.

GENTLEMEN:—The term *nature*, in its Latin derivation, implies every born thing. It embraces not only matter but its properties and laws. It is coextensive with the word *creation* in that wonderful chapter of condensed knowledge, wherein the Creator first communicates to man by written records the origin of his race, and the source and order of the visible world, and against which, especially in this modern age, all the hosts of unsanctified learning, ridicule and wit have encamped in hostile array.

The ancients to express the material creation and its study employed the word *physica*. In their system of education it maintained priority, after which came the study of the human mind, or the *metaphysica*.

The application of the intellectual powers to natural investigation is the most rational occupation of our race. It is thus that we obtain the most exalted and pure views of the goodness, power and wisdom of the Creator. It is thus that the intelligence unaided by revelation may reason out the existence of a great *first cause*, or as it is rendered by the poet, rise

"Through nature up to nature's God."

To the finite mind all science is originally chaotic; darkness broods over its depths, until the spirit of inductive inquiry commands the light to shine forth, evoking order and form. Its structure is not the work of one, but of many; it does not spring into maturity, like the goddess, from the brain of Jupiter. It is a composite, in which every piece is bound to its fellow by the cement of

experimental truth. Its progress goes on like the uprising of a temple, fragment after fragment, until the capstone is laid; or, like the great luminary of light which coming forth out of the chambers of the east shineth more and more unto the perfect day. As an illustration of this fact, I have selected as the theme of the present address, the classification of the animal kingdom.

Turn your eyes over her vast domain—the earth, the waters of the sea, the air, illimitable space, the mind is overpowered by number, variety and complexity. But look again, and we discover the chemical existence of many obvious distinctions which commend themselves even to superficial observation. Take a handful of soil, or, what is the same thing, a portion of rock, for the former is but the crumblings of the latter under the triturating agencies of summer's heat and winter's cold, we will perceive that it consists of homogenous parts; that it may or may not have a determinate form; that if it grows it is by accretion or external addition; that you may break off a portion which contains all the parts of the whole, and is therefore perfect in itself; that no mutuality of relation subsists between its parts, and that it possesses no apparatus or special organ for addition, subtraction or propagation. To all such objects, the term *inorganic* is applied. Others, again, are seen to possess a variety of parts constituting organs, and both in their parts and organs to sustain a determinate relation and dependence to one another. They are constantly receiving new materials, which in virtue of such organs become part of their composition, not by simple aggregation, but by selection and assimilation, from which result growth and form. By the possession of special organs, they are able to perpetuate their *kind*, and when they have fulfilled their allotted round of vital activity, they die and are resolved into simple elemental forms, which sinking into the earth, or rising into the air, enter into other combinations, to-day in the person of a king, to-morrow in the grass of the field; to-day in the mass undergoing incipient decomposition, to-morrow in the flower whose redolent perfumes enrich a conservatory. All such are called *organic*. These, then, the inorganic and organic, constitute the two grand primary divisions of all natural objects. The organic is next made the subject of a further division into the *animal* and *vegetable*. It may seem rather singular to those who have not examined the subject under consideration, to learn that it is a matter of no small

difficulty to state in what the distinction between these two departments consists. Will you say appearance is alone sufficient to determine the subject: that you never could mistake an ox for an oak? This would be a very deceptive criterion by which to adjust the true affinities of the organic kingdom. A whale in external resemblance and the medium in which it lives, favors a fish much more than a man; and yet no naturalist questions the propriety of placing it in the class of mammals. *Organization*, not form, is the only philosophical foundation of classification. The two kingdoms, like the radii of a circle, are sufficiently wide at their periphery to avoid confusion, but they almost touch at the other extreme. So close, indeed, is the contact, that upon this narrow boundary line some of the most exciting encounters of naturalists have taken place, each claiming for his respective department the crowds of diminutive existences which there congregate in such vast numbers as utterly to defy all computation.

Let us attempt some of the criteria which would naturally suggest themselves as furnishing ground for distinction. Plants are fixed to a definite locality or spot, animals are not. Generally speaking, this is true, but it is far from being sufficiently universal for the construction of a law, as there are many plants which are not unchangeably fixed to any single place, but which float ever upon the waters of the sea, from which they draw the materials of growth. Animals possess the function of respiration, so do plants; and although the human lung, the gills of a fish, or the spiracle of an insect, possess very little resemblance to a leaf, yet the same, or similar, chemical combinations and products take place in both. Animals have a circulation, so have plants. The web of a frog's foot and a sprig of *natella*, when placed within the field of the microscope, will each exhibit to the wondering eye the movement of the nutritive fluids. Plants are more simple in their elementary constitution than animals; but a polyp, in this respect, is less complex than a tree. Plants have no heart to propel the nutritive fluids, but many animals are destitute of such an organ. Plants possess no nervous system, and so also there are animals so low in the scale of organization that no nervous system, however elementary, has been demonstrated to exist. Animals possess a power of motion in response to internal or external stimuli; but the spores of certain confervæ manifest the same sensibility to external con-

tact, the resemblance between which and infusorial animals is most striking. Plants have only at certain periods organs of fecundation; but the same may be said of very many insects which acquire these after having undergone the larval metamorphosis. Nevertheless, in spite of all these resemblances, there are certain points of demarcation, distinct, though they be fine. The one is never merged into the other. The odious doctrine of Treviranus, that plants may be developed into animals, is never true. Probably the most truthful distinction, in view of our present knowledge, is founded in the food of the respective kingdoms. The vegetable subsists on inorganic matters, from which are formed organized compounds; animals are maintained by organic products, and can never form such, wonderful and various as are their chemical operations. I am aware the universality of this proposition has been denied. Schwammerdam asserts that there are certain worms which live exclusively upon mud, and that he was never able to discover anything else in their intestines. Humboldt, a name coextensive with the world, relates of the people living near the Orononco River, that they live for as many as three months of the year upon a soft clay deposited on its banks. Other travelers make mention of similar examples. During the year 1832, in consequence of impending famine, the Scandinavians sustained life by a similar expedient. Not long since, Retzius, whose mind had been attracted to these facts, subjected some of the earth used by the last named people to the scrutiny of a microscopic test, and in which he discovered no less than nineteen different varieties of *infusoria*, so that whatever agency the mud may have exerted in supporting life, it was due to the organic remains which were present.

One of the first occupations of the great progenitor of our race was to give appropriate names to all the animals which God had created, as they were made to pass before him in panoramic procession—

> And as he spake each bird and beast, behold,
> Approaching two and two, these cowering low
> With blandishment; each bird stooped on his wing,
> I named them as they passed, and understood
> Their nature, with such knowledge God endued
> My sudden apprehension.

It must have very early occurred to any one in the habit of obsery-

ing the animal creation, that between different individuals there existed such common points of resemblance as to admit of their being gathered into groups.

Classification was early felt to be a necessity, without which there could be no progress; and it is unquestionably true that such a work demands for its execution the most comprehensive and profound mental endowments, and he who first opened a pathway into this before untrodden solitude of knowledge, justly stands in intellectual superiority without a peer. A class is compound in its structure. Analyzed, it is found to include *orders*, under which are ranked *genera*, and still deeper, as a nucleus, *species*. In the structure of the science of numbers or language, numerals or letters are the first necessity; so in the proper systematic arrangement of animals, the species lies at the foundation of the whole subject.

Aristotle, the head of the Peripatetic philosophy, who was born 384 years before the Christian era, may be considered as the first who made any successful attempts toward a system of classification at all comprehensive and accurate, and, considering that the work was comparatively new and untried, and that he should have seized upon the great and guiding idea of organization, it is impossible not to regard with astonishment the genius and profundity of his mind. His arrangement was founded upon the sanguine fluid. Supposing that only to be blood which possessed the red color, he divided all animals into two primary groups—those *with blood*, and those *without blood*, making out of these other subordinate distributions. This corresponded to the more modern arrangement of the *vertebrated*, and *invertebrated* animals.

Pliny, not satisfied with the Aristotolean system, attempted to substitute it by one founded on the *mediæ* in which animals lived. It embraced three classes—*Terrestrial*, *Aquatic*, and *Atmospheric*, which has long been abandoned for a more philosophical method.

Next came the great Swedish scholar, Linnæus, a name which will command the veneration of learning to the end of the world. And it is a matter unpardonable, as it is inexplicable, that the same Sweden, which voted a public funeral to him whose genius and intellect had reflected glory upon the nation, five years after should allow his books and herbarium to be sold in England for the paltry sum of 100 guineas. Like Aristotle, he retained the two primary divisions of animals, with this modification, that those held by the

former to be *bloodless* he styled *white-blooded*, and then seizing upon the circulation as the basis of adjustment, he disposed of all under three divisions, which may be stated as follows:—

1. Animals having a heart with one cavity and with cold white blood.	With antennæ—Insects. With tentaculæ—Worms.
2. Animals having a heart with one ventricle and one auricle, and cold red blood.	If lungs be present—Amphibiæ. If gills—Fishes.
3. Animals having a heart with two ventricles and two auricles, and warm red blood.	Viviparous—Mammals. Oviparous—Birds.

Linnæus was the first to apply to animals the double appellation, expressive of both the genus and species; an expedient of great importance in preventing confusion, and giving preciseness to zoological nomenclature. Thus, the term *Bos* is a generic one, signifying ox, but as it comprehends several species, they are designated as Bos Taurus, Bos Bubulus, Bos Moschatus, &c.

However much there is to admire in the Linnæan system of classification, yet in consequence of anatomical inaccuracy, and the subordinate importance of the circulation in the animal series it could not maintain a lasting perpetuity. In nothing was the system so greatly defective as in the two large classes under his first great division of animals possessing but one cardiac cavity, and which embraced *insects* and *worms*. As the investigations of entomologists have been extended, great numbers of such are known to be entirely destitute of any central organ corresponding to a heart, while others exceed the conditions of the law, and possess one containing both an auricular and ventricular cavity. The careful study of comparative anatomy, and a faithful tabulation of the different systems of the animal series, with a view to their fundamental import, gradually opened the way for a more natural, and, of course, more philosophical arrangement. Cuvier, the French anatomist, who died in 1832, stands pre-eminent for his achievements in this field. His *Reigne Animale* will ever remain a monument of industry and incomparable intellect. Before passing on to the Cuvierian system, it would be unpardonable to omit making some notice of the indefatigable and scientific labors of the celebrated John Hunter, who not only enriched and ennobled British medicine, but con-

tributed greatly to the solid progress of natural science. This distinguished *savant*, with the object of determining the essential organic value of the different systems in the chain of animality, set about the arduous task of constructing synoptical tables, which embraced the apparatuses of circulation, respiration, digestion and enervation. The result of his patient and laborious work tended to give an additional importance to the circulatory system, the same upon which rose the zoological structure of Linnæus. His method ranked all animals under five heads:—

First. Such as have hearts with *four* cavities, and which includes Mammals and Birds.

Second. Such as have hearts with three cavities, and which includes *Reptiles* and Amphibia.

Third. Such as have hearts with two cavities, and which includes Fish and Molluscs.

Fourth. Such as have hearts with a single cavity, and which includes all the *Articulata.*

And *Fifth.* Animals in which the same organ performs the work of both heart and stomach.

No naturalist will undervalue the labors of Hunter. While it is acknowledged he did not succeed in establishing an unalterable basis of classification, yet he signally advanced the science, and furnished voluminous data to illuminate the path both of contemporaries and successors.

The work of Cuvier, to which we have already alluded, forms an important accession to the literature of our subject. This distinguished author formed *two* grand divisions of the animal kingdom, based on the presence or absence of a spinal column, and which he called the *vertebrated* and *invertebrated*, corresponding to Aristotle's *blood* and *bloodless* groups, or the *red* and *white* blooded divisions of Linnæus. These were next distributed into classes, *four* of which were constructed out of the *vertebrata;* and *five* afterward increased to *twelve* by his colleague, Lamarck, from the *invertebratæ.*

The later labors of Cuvier induced him to arrange all animals under *four* divisions, termed *vertebrates*, *molluscs*, *articulates*, *radiates.*

With this celebrated scholar the nervous system was considered as paramount to everything else in graduating the scale of animal

affinity; and just in proportion as the knife of the anatomist has faithfully explored the interior organization, have these views been more and more certainly corroborated. In the four groups of vertebrated animals the centres of this system are provided with a canal for their protection, formed either of cartilage or bone, and placed along the posterior aspect of the body. This is the cranial and spinal canal, and the masses of neurine occupying it, form the *cerebro-spinal axis* with which the nerves traversing the different parts of the body, like so many telegraphic wires, are connected, bringing it into relation with objects exterior to itself. In these groups there are never more than four limbs, and the upper and lower jaws are placed the one above the other.

In the other groups of animals we have a much more simple and elementary condition of the nervous system. In *molluscs* it is in the same cavity with the viscera, and consists of scattered ganglia, some of which are uniformly placed around the æsophagus, similar to a collar, and the others scattered on the abdominal surface of the animal. From the sub-æsophageal ganglia proceed the nerves which supply the organs of digestion, of respiration and generation. They possess nothing which can properly be called a skeleton; the muscles, which are destitute of transverse striæ, being inserted into the skin.

In the *articulates* a higher and more orderly development of the nervous system becomes conspicuous. The æsophagus is embraced by the cords which connect the first ganglion, placed in the head, with the second. The other ganglia are arranged in a row along the belly, and connected by two delicate threads. This is a true spinal cord, the two threads of which are so related to the ganglionic masses that one only is connected to these centres, the other passing over. This discovery, which was made by Newport, in 1834, presents us with the earliest rudiments of the vertebrated spinal axis, with its motor and sensory columns. More recently the labors of Schwammerdam and Mueller have brought to light, particularly in the more perfect insects, another nervous system, which, commencing by ganglionic masses in the head, sends communicating filaments to the supra-æsophageal one of the spinal, and passing over the posterior surface of the æsophagus, is distributed to it and the stomach. This system is regarded as either an *elementary*, *sympathetic*, or *par vagum*.

The skeletons of the articulata consist of rings or segments of

considerable resistance, and into these the muscles are inserted. There are generally *six* limbs present, though they may exceed this number, or, in exceptional cases, be entirely wanting; and the jaws, when present, are placed side by side.

In *Radiates* the nervous system is placed as a ganglionic collar around the mouth, and from which the nervous cords run like rays to the different prolongations of the animal. The skeletons of such are firm and frequently calcareous in their consistence. It is to this last division of Cuvier that the greatest objections are urged. It is entirely too heterogeneous in composition—its elements too diverse in their organic relations.

Since the introduction of the microscope as an instrument of scientific investigation, most wonderful revelations of an otherwise invisible world have been brought to light. The dreams of the far-seeing Buffon assume the form, nay, the certainty of truth: the heavens above, and the earth beneath, visible to the eye, had conveyed to the mind, in the multitude and variety of their objects, the idea of wisdom and boundless resource; the telescope had penetrated the veil which limited the unarmed vision, opening up new systems of ponderous worlds, so great in magnitude, so marvelous in distance, as to overpower the mind in contemplating the omnipotence of Him whose fingers formed and arm sustains this stupendous frame. And now, to render our conceptions complete, the microscope peers down into the other extreme of nature, to learn from its teeming millions the exhaustless skill and condescending minuteness of God's handiwork, which

> "Lives through all life, extends through all extent,
> Spreads undivided, operates unspent."

What a force and a fullness of meaning there seems now to be in the declaration, that the "hairs of our head are all numbered, and that not a sparrow falls to the ground without the divine notice.' This instrument, with a closer study of the nervous system, has tended to elaborate a more accurate and natural zoological arrangement, and which is well expressed in Jones' Outlines of the Animal Kingdom, under *five* grand divisions.

The first is designated by the term *Acrita*, implying that the members of this division agree in being without discernible parts or organs; at least, none such have been detected. Assuming, however, that neurine is an indispensable condition of animal life, it is

supposed to exist in a molecular form, scattered through the body of the animal. This same division has been termed *Protozoa*, literally the first animal, or *Infusoria*, from having been found to exist in liquids containing vegetable matter.

In 1675 Leeuwenhoeck discovered these simple and most elementary forms of animal life. If you take a drop of water containing some organic matter, and place it in the field of a microscope, you will perceive throngs of diminutive animals instinct with living activity. Adjust now your micrometer, and you will learn that many of these do not exceed the $\frac{1}{2000}$ of a line in size; so small, indeed, that in this single drop, which to them is a vast and shoreless sea, it is possible for a thousand millions to exist. They are found in air, earth and water, swarming in countless myriads beyond all powers of computation. Ehrenberg, the German naturalist, who has spent much time and curious research in this department, found them sailing in the dust, borne on the wings of the trade winds; they are seen 2,000 feet above the level of the ocean; the sea itself they sometimes light up for miles in one resplendant glow of phosphorescent fire, and fields of spotless snow they occasionally appear to transmute into a quiescent lake of blood. The immense chalk cliffs, which lift their whitened heads along the Irish channel, and the tertiary formations of limestone, are composed in a great measure of their skeletons; in a single ounce of sand, gathered from the shores of the Adriatic or Antilles, more have been computed than there are inhabitants in the four largest cities on the face of the globe. The fossiliferous remains of the *Miliolæ* compose fully one-half of the magnificent structures which adorn the City of Paris; and many of the monumental piles which rise up from the historic soil of Egypt have been reared of stones formed from petrifactions of microscopic animals.

From the necessarily restricted limits of this lecture, I cannot more than allude in the most general manner to the anatomical peculiarities of the different divisions.

The nervous matter, if present, (and such is presumable,) is in diffused granules; they certainly do not possess the higher senses, and common sensibility will be determined by the presence or absence of neurine. There are no muscular fibres, though their movements may depend on the presence of sarcous elements, existing like the nervous, in a molecular state. The apparatus of digestion is a simple cavity, more or less complex, excavated out of the body

of the animal, and which answers the purpose of both digestion and circulation, and they multiply by division, fission, budding, and ova.

Under the *Acrita* are ranked four different classes, distinguished by the significant names of *Protozoa*, *Phytozoa*, *Hydrozoa*, *Entozoa*. Among these are to be found some of the most curious works of nature, and existing in such unlimited numbers as to convey to the mind, as nothing else could, the superabounding profusion of animal life.

Here are Polyps, with bristling arms set all abroad in wait for prey; Medusæ, whose countless hosts, stirred by the ship's keel as she ploughs the waters of the Mediterranean, gild her wake in long lines of brilliant sheen; the little Physalius, with air-bladder and purple sail, driving along the main like a man of war; so, too, the Fungiæ and Meandrinæ, by whose silent yet ever extending outgrowths are formed those immense reefs of coral, which rise and extend in walls of massive masonry, until, like the harbor of Tinian, the sea itself becomes filled; together with various parasites, sexless and bisexual, which, singular as it may appear, find in the brain, liver, heart, muscles and eyes, a habitat congenial to their nature.

The second division is the *Nematoneurea*. In it the nervous system assumes the form of cords or filaments; no senses are present unless it be that of touch; muscular fibres also appear; the alimentary cavity is distinct, and provided with muscular walls; the circulation of the fluids takes place in distinct canals, and their propogation is effected by ova. There are *five* classes under this division, technically termed *Bryozoa*, *Rotifera*, *Epizoa*, *Cœlelmintha* and *Echinodermata*.

The third division is called *Homogangliata*. This corresponds with Cuvier's Articulata. They possess ganglionic centres, with filamentous connections, arranged in parallel lines, and corresponding to the segments of the animal. A sympathetic system also makes its appearance; the higher senses are well marked; contractile vessels propel the circulating fluid, and they possess a skeleton of sufficient resistance and solidity to qualify them for an existence in other mediæ than water.

This division embraces *five* classes, which are called *Annelids*, *Myriapods*, *Insects*, *Arachnoids* and *Crustaceans*.

The individuals under these classes have always attracted a very large share of scientific attention. Here are to be found the *Serpula*, with his elegant respiratory tufts and calcareous mail; the *Aphrodite Aculeata*, prized so highly as a bait by fisherman, with its rows of symmetrical setæ reflecting brilliantly all the colors of the rainbow, and yet every hair by its barbed margins a weapon of efficient defence; the flea (*Pulex Iratans*) and the mosquito, so conducive to sound rest and pleasant dreams; the spider, (*Araneidæ*,) like a politician or tradesman, weaving from delicate spinarets his net, with a care so cunning and treacherous as to utterly confound precaution; and the ant, (*Termes*,) whose industry has furnished in all times a text of rebuke to the sluggard and improvident. And so might we mention the medicinal leech, (*Hirudo Medicinalis*,) and the *Cantharis Vessicatoria*, nature's bleeders and blisterers; the *Alphides*, or plant lice, whose fecundity is such that a single intercourse is sufficient to insure a progeny to the ninth generation, a population greater than all the inhabitants of the world: some, too, the scourge of the husbandman, desolating field, vineyard, and orchard; some to enrich civilization and trade with their silk, honey and wax; some with harp and dulcet, to play the part of strolling minstrels; some, by their barometrical instincts, to instruct our reason; some whose whole circle of life revolves in a few hours; some whose periodicity extends over many years; some who spring into being complete at once, and some who only attain to the perfection of insect life after passing through a mysterious metamorphosis.

The fourth division is the *Heterogangliata*, corresponding to Cuvier's Mollusca. The term employed to distinguish this division is designed to express, as in the others, some peculiarity of the nervous system, consisting in a symmetrical arrangement of its parts. The supra-œsophageal ganglion maintains the same position; but the others, while they maintain a communication with it, are scattered, without any reference to order, through different parts of the animal. *Six classes* are grouped under this division, called respectively *Tunicata*, *Choncifera*, *Brachiopoda*, *Pterepoda*, *Gasterepoda*, *Cephalopoda*. These classes furnish numberless objects, the study of which might profitably occupy a lifetime. As familiar examples of a few of these animals, we may instance the *Mytillus Margaritiferrous* of the Persian Gulf, furnish-

ing the finest pearls in the world; the *Toredo*, with his fatal borer, the scourge of the shipmaster, so famous in connection with the dykes of Holland, and in 1730 threatening the entire destruction of the island of Walcheran; the oyster, whose adaptation to our gastronomic wants is so familiar to all; the *Unio*, with his singular moorings; the *Helices*, or snails, whose slimy tracks so much excite the irrascible housewife; the *Fissurella*, with his gaudy canopy, moving on the bottom of the sea not unlike a city belle with hoisted parasol; the *Clio*, with his transverse paddle, from whom no doubt the inhabitants of Greenland borrowed the double-barrelled oar with which to guide their canoes; and, finally, the horrid *Octopous*, or sea poulpe, the scourge of the ocean, against whose nine hundred and sixty sucker armed tentacles man himself cannot cope.

The fifth, and last grand division of the animal world, is the *Vertebrata*. By Owen, who may be considered the most profound naturalist of the present day, it is termed *Myelencephala*, and by others *Spinicerebrata*.

It comprises *five* groups or classes. *Fishes*, *Amphibia*, *Reptiles*, *Birds*, *Mammals*. The distinguishing characteristics of these are to be found in the existence of an organized internal skeleton; a nervous system, concentrated and complex, presiding over organic and animal life, and provided with a spinal and cranial chamber for its protection; the organs of sense assuming the highest importance, and the presence of attributes indicating an intelligent essence. It is under this division that *man* appears, made in the likeness of the invisible God, the crowning act of creation, the epitome of all the kingdoms, and clothed by the Almighty fiat with the dignity of universal dominion.

Such, gentlemen, is a very rapid survey of the zoological system in its most important features. Our object being only to communicate the great principles which underlie the subject of arrangement, we have not descended below *classes*. Its structure is exact and rigidly logical; it is not the work of syllogism. During the two thousand years in which men groped after truth under the domination of the organum of the Stagarite, not a principle was established. The classification of the animal kingdom on its present basis is purely an *inductive* triumph—the soul and essence of all solid progress; the same that animates the labors of the statis-

tician, appoints seats of observation, builds the laboratory of the chemist, kindles the fires of analysis, and in a thousand ways summons *nature* before the tribunal of experiment and observation.

In conclusion, gentlemen, let me extend to you on this, the occasion of our first introduction, a hearty and hospitable welcome. I suppose there are here to-night representatives from every State of the Union, as well as from the British American Provinces. And at this day, when the public mind is agitated upon the turbulent sea of political excitement, it is a glorious thought that there is one altar around which all sections can gather as brethren, and upon which they can make a common consecration of themselves to the holy cause of humanity: it is the altar of science. May its fires never grow dim; may its sacred precincts never be pressed by the footsteps of alienation or fanaticism.

You have left homes of happiness and love; the prayers of many tender and trembling hearts have followed you to this place of temporary sojourn. When Virgil sailed for Athens, Horace invoked the winds to be propitious, as they bore away one-half of his soul; but what are the dangers of the sea when compared with those which encompass one full of the strength and fervid energy of unsuspecting youth, unloosed from the restraints and experience of parental watchfulness, and thrown suddenly into the vortex of metropolitan society. The danger is imminent in the extreme. Every man carries a traitor in his bosom, and one which is ready, whenever the price is paid down, to throw open the doors to the enemy. The moral and intellectual constitution are constantly influenced by disturbing and antagonistic forces. It is like a camp in which the elements of insurrection and rebellion exist; the passions crave gratification and unlawful indulgence; the will and moral sentiments confront and deny assent; and, alas, how often does such remonstrance prove powerless and futile. In the fabulous story of Hercules and Antæas, the Lybian giant acquired new power by every contact with his mother earth; nor could the son of Jupiter terminate the conflict, until, lifting him aloft in one mighty embrace, he was enabled to crush out his life. And so, my young countrymen, to be successful in the great struggle against the vices of our nature, we must rise above the earth; we must invoke supernatural aid, and gather strength for the conflict in an atmosphere uncongenial to their growth.